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Abstract: Objective: To compare individuals with and without schizophrenia spectrum disorders (SSD) (schizophrenia, schizoaffective disorder, or psychotic disorder not otherwise specified) who die by suicide.

Method: This retrospective case control study which compared all individuals who died by suicide in Ontario, Canada with (cases) and without (controls) SSD between January 1, 2008 and December 31, 2012. Cases (individuals with SSD) were compared to controls on demographics, clinical characteristics, and health service utilization proximal to suicide. A secondary analysis compared the characteristics of those with SSD and those with severe mental illness.

Results: Among 5,650 suicides, 663 were by individuals with SSD.SSD suicides were significantly more likely to be between the ages of 25-34, and significantly more likely to reside in the lowest income neighbourhoods and urban areas. They were also significantly more likely to have comorbid mood and personality disorders and all types of health service utilization, including outpatient mental health service contact in the 30 days prior to death, even when compared with those who had a history of mental health hospitalization.

Conclusions: Individuals with SSD account for over 1 in 10 suicide deaths, tend to be younger, poorer, urban, more clinically complex, and have higher rates of mental health service contact prior to death. The demographic and service utilization differences persist even when compared with a population with severe mental illness that is not SSD. Suicide prevention strategies for individuals with SSD should emphasize the importance of clinical suicide risk assessmen, particularly early in the course of illness.

*Cover Letter

Service utilization and suicide among people with schizophrenia spectrum disorders

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Response to Reviewers

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Thanks very much,

Juveria Zaheer

Service utilization and suicide among people with schizophrenia spectrum disorders

Abstract

Objective: To compare individuals with and without schizophrenia spectrum disorders (SSD) (schizophrenia, schizoaffective disorder, or psychotic disorder not otherwise specified) who die by suicide.

Method: This is a retrospective case control study which compared all individuals who died by suicide in Ontario, Canada with (cases) and without (controls) SSD between January 1, 2008 and December 31, 2012. Cases (individuals with SSD) were compared to controls on demographics, clinical characteristics, and health service utilization proximal to suicide. A secondary analysis compared the characteristics of those with SSD and those with severe mental illness (defined as those without SSD who have had a psychiatric hospitalization within the five-years before suicide (excluding the 30 days prior to death)).

Results: Among 5,650 suicides, 663 (11.7%) were by individuals with SSD. Compared to other suicides, SSD suicides were significantly more likely to be between the ages of 25-34. SSD suicide victims were significantly more likely to reside in the lowest income neighbourhoods and to reside in urban areas. SSD victims were also significantly more likely to have comorbid mood and personality disorders and all types of health service utilization, including outpatient mental health service contact in the 30 days prior to death, even when compared only with those who had a history of mental health hospitalization.

Conclusions: Individuals with schizophrenia spectrum disorder account for over 1 in 10 suicide deaths, tend to be younger, poorer, urban, more clinically complex, and have higher rates of mental health service contact prior to death. The demographic and service utilization differences persist even when the SSD group is compared with a population with severe mental illness that is not SSD. Suicide prevention strategies for people with schizophrenia spectrum disorder should emphasize the importance of clinical suicide risk assessment during clinical encounters, particularly early in the course of illness.

Introduction

People with schizophrenia spectrum disorders (SSD) have significantly higher rates of death by suicide compared with the general population.(Bjorkenstam et al., 2014; Brugnoli et al., 2012; Fazel et al., 2014; Nordentoft et al., 2011, 2004) Studies report a lifetime risk of 4-5% with evidence that risk of suicide is highest early in the course of illness.(Bakst et al., 2010; Dutta et al., 2012; Fleischhacker et al., 2014; Palmer et al., 2005) Suicide is the leading cause of premature death in SSD, and identifying individuals with SSD who are at high risk for death by suicide is an important clinical, research and public health priority.(Fleischhacker et al., 2014)

Epidemiological studies have identified population-based risk factors that are routinely incorporated into clinical assessments to identify, and intervene with, individuals at high risk of suicide. However, individuals with SSD may differ from the general population with respect to suicide risk factors and may require different types of suicide interventions. There are few (or no?) studies that systematically compare those who die by suicide in SSD vs. other psychiatric diagnoses. Furthermore, the generalizability of existing studies is limited by small sample sizes, the use of clinical samples, and diagnoses made retrospectively through psychological autopsy.(Banwari et al., 2013; Cavanagh et al., 2003; Lopez-Morinigo et al., 2014) Suicide is a rare outcome and a retrospective, population-based study and validated algorithm for diagnosis ascertainment allows for a rigorous analysis of the percentage of suicide victims with SSD and the differences in demographics, clinical features and mental health service utilization in those with and without a diagnosis of SSD.

The objective of this study was to examine the characteristics of those who die by suicide with and without SSD. Our hypothesis was that individuals with SSD would have a much larger suicide prevalence relative to best estimate of a population-based one-year prevalence rate of 0.6

(95% CI 0.38-0.91) and will have uniquely different suicide risk factors compared to individuals who die by suicide without SSD.(Goldner et al., 2002)

Methods

Data Sources

Ontario is Canada's most populous province, with approximately 13 million people.(*Open Minds , Healthy Minds: Ontario's Comprehensive Mental Health and Addictions Strategy*, 2011) The Ontario Ministry of Health and Long-Term Care provides coverage for all medically necessary services to residents and captures administrative data reflecting health care utilization. The Institute for Clinical Evaluative Sciences (ICES) holds these health administrative data sources which are linked via an encrypted unique identifier. The Office of the Registrar – Deaths (ORG-D) database captures all deaths in Ontario and includes cause of death, including suicide. The Registered Persons Database (RPDB) captures demographic information including date of birth, sex, residential neighbourhood, and date of death. The Ontario Health Insurance Plan (OHIP) database captures information related to physician billings, including visit date and diagnosis. The National Ambulatory Care Reporting System (NACRS) identifies emergency department service utilization and diagnosis. The Ontario Mental Health Reporting System (OMHRS) captures information from hospitalizations occurring in psychiatric beds starting in 2005 and the Canadian Institutes of Health Information Discharge Abstract Database (CIHI-DAD) captures information from hospitalizations in non-psychiatric beds.

Study Participants

The study sample consists of all Ontario residents who died by suicide between January 1, 2008 and December 31, 2012. Suicides were captured by several databases (ORG-D, NACRS,

OMHRS and DAD) and were cross referenced to create a cohort of unique suicides. We identified the majority (n = 5,697, 96%) of suicides within ORG-D using ICD-10 codes. A small number of suicides (N=219, 4%) were also identified in NACRS (death by suicide during an ED visit), OMHRS (suicide during psychiatric inpatient hospitalization), or DAD (death by suicide during inpatient hospitalization). Subjects were excluded if they had an invalid Ontario health card number within 5 years of death (n = 265, < 5%).

Within this sample, all individuals who were diagnosed with a schizophrenia spectrum disorder (SSD) (schizophrenia, schizoaffective disorder, or psychotic disorder not otherwise specified) in Ontario between July 1, 1993 and December 1, 2012 were identified by a validated algorithm.(Kurdyak et al., 2015) The July 1, 1993 start date was chosen to maximise the number of subjects who were diagnosed with SSD captured while maintaining consistent data quality. The end date was chosen to ensure that service utilization 30 days prior to death by suicide was not double counted as both a diagnostic and service utilization factor. The diagnostic algorithm included all individuals who received these diagnoses at hospitalization discharge or during three visits to a physician over a 36-month period (sensitivity 93%; specificity 59%, PPV 66%, NPV 91%). This algorithm has the advantage of including SSD cases that are not routinely hospitalized, and therefore generates a SSD sample that is more representative of the entire population instead of a more acutely ill sample.

Schizophrenia and schizoaffective disorder are typically included in population-based studies on schizophrenia spectrum disorders. Psychotic disorder not otherwise specified (NOS) is also included because its presence improves test characteristics for health administrative data algorithms. In addition, the majority of individuals with a psychotic disorder NOS diagnosis are eventually diagnosed with schizophrenia or schizoaffective disorder.(Kurdyak et al., 2015; Pope

et al., 2013) This algorithm was consistent with previous literature where "schizophrenia", "schizophrenia spectrum disorders" and "non-affective psychoses" are used interchangeably in suicide research.(Fazel et al., 2014; Gallego et al., 2015; Høye et al., 2011)

A secondary analysis compared the schizophrenia spectrum disorders group with a subgroup of controls who had a previous history of mental health hospitalization in the 5-year period before death excluding the 30 days prior to death. Hospitalizations were included if they appear in CIHI-DAD with a mental illness discharge diagnosis (F00-F09; F20-F99) or if they were included in OMHRS. These groups were compared to ensure that the demographic, clinical and service utilization differences found in the first comparison were specific to SSD and not simply related to having a serious mental illness.

Covariates

Sociodemographic characteristics included age by group (<24, 25-34, 44-54, 54-64, 65+), gender, neighborhood income quintile at the Census tract level and rurality of residence at time of death. Neighbourhood income quintile was derived from Canadian Census data captured in 2006. Rurality at time of death was determined by the Rurality Index of Ontario (RIO) score. The RIO uses postal codes to assign a score on a 100-point scale.(Kralj, 2000) A score of 40 or greater was considered a rural residence.

Comorbidities included a measure of general comorbidity, a diagnosis of an alcohol use disorder or of a drug use disorder and diagnoses of a mood disorder or personality disorder (excluding the 30 days before death). General comorbidity, including both medical and psychiatric/psychosocial comorbidity, was measured using Johns Hopkins Aggregated Diagnosis Groups (ADGs).(Austin et al., 2011) Johns Hopkins ADGs are predictors of mortality in the general population and in a

schizophrenia population.(Austin et al., 2012, 2011) Presence of an alcohol use disorder was determined by including all subjects who, within five years of death, were diagnosed with an alcohol use disorder by any physician in any setting (OHIP-based ICD-9 code 291 or 303), were diagnosed with an alcohol use disorder or related condition in an emergency department or medical inpatient setting (ICD-10 diagnostic code F100-F109, G312, G621, I426, K292, K700-K703, K709, R780, or T510), or a diagnosis of an alcohol use disorder in a psychiatric inpatient setting (ICD-9 diagnostic code 291 or 303). Presence of a drug use disorder was determined by including all subjects who, within five years of death, were diagnosed with an drug use disorder by any physician in any setting (OHIP-based ICD-9 code 292 or 304), were diagnosed with an drug use disorder or related condition in an emergency department or medical inpatient setting (any of ICD-10 diagnostic codes F11.0-F16.9; F18.0-F18.9; T40.0-40.9, T41.3; T42.3-42.4 in NACRS or DAD), or were diagnosed with a drug use disorder in a psychiatric inpatient setting (ICD-9 diagnostic code 292 or 304). Presence of a mood disorder was determined by including all subjects who, within five years of death, were diagnosed with either a mood disorder or depressive disorder in any clinical setting (OHIP-based ICD-9 code: 296 or 311). Presence of a personality disorder was determined by including subjects who, within five years of death, were diagnosed with these illnesses in any clinical setting (OHIP-based ICD-9 code: 301)

Previous suicide-related behaviour requiring emergency care or hospitalization was ascertained through NACRS using ICD-10 codes for deliberate self-harm with either firm or undermined intent (X60-X84, Y10-Y19, Y28), in keeping with previous literature validating this approach using ICES data.(Bethell and Rhodes, 2009) Previous suicide-related behaviour was measured within the five years prior to death by suicide as well as in the 30 days prior to death by suicide.

Health service utilization covariates were measured 5 years prior to death by suicide (excluding the 30 days prior to death), as a measure of general health system engagement and burden of psychiatric illness, and in the 30 days prior to death by suicide, as a potential opportunity for suicide intervention. Health service utilization measures included outpatient psychiatrist, primary care, and non-psychiatrist specialist visits, ED visits and hospitalizations. Primary care physician visits were categorized as mental health vs. non-mental health-related visits based on a validated algorithm.(Steele et al., 2004) ED visits were included if they were related to a NACRS discharge diagnosis of an ICD-10 mental health or addictions code (F00-F09; F20-F99). Hospitalizations were included if they appear in CIHI-DAD with a mental illness discharge diagnosis (F00-F09; F20-F99) or if they were included in OMHRS.

Statistical Analysis

Descriptive statistics (t-tests for continuous variables, Chi-square/Mantel-Haenszel for dichotomous and ordinal variables) were used to compare completed suicide cases with schizophrenia spectrum disorder vs. those without. We also used logistic regression to determine the variables that were independently associated with a schizophrenia spectrum disorder diagnosis in those who die by suicide. The primary variable was the presence or absence of SSD among people who died by suicide. The covariates of interest included sociodemographic characteristics (sex, age by category, rural residence, neighbourhood income quintile), comorbidities within five years and 30 days of death (general medical comorbidity measure, presence of alcohol use disorder, presence of drug use disorder), history of suicide-related behaviour requiring medical attention (within five years and 30 days of death), and health service utilization data including outpatient psychiatric care, ED visits for mental health reasons, and mental health hospitalization (within five years and 30 days of death).

Results

Cohort Development

5,697 suicides were identified from the ORG-D database and a further 219 were identified from other data sources in Ontario between January 1, 2008 and December 31, 2012 (Table 1). After excluding 1 case with a missing death date and 265 cases because they were not eligible for coverage under the OHIP in the 5 years prior to suicide death, there were 5,650 suicide deaths included in this study, among whom 663 (11.7%) were associated with a diagnosis of schizophrenia, schizoaffective disorder or psychosis not otherwise specified.

Demographic characteristics

SSD suicides accounted for 10.3% of all male suicides, and 15.7% of all female suicides (Table 2). The SSD suicide group had a greater proportion of female suicides than the non-SSD group, and were significantly younger, accounting for 21.7% of all suicides in the 25 - 34 age group and only 7.7% of all suicides over the age of 65 (Table 2). SSD suicide victims were significantly less likely to live in rural areas and were more likely to reside in the lowest income neighbourhoods (Table 2).

Comorbidities

The Aggregated Diagnosis Group (ADG) score over the last five years was significantly higher in the schizophrenia group; they were also significantly more likely to have been diagnosed with an alcohol use disorder or a drug use disorder (Table 2). They were significantly more likely to have a diagnosis of other illnesses associated with suicide, such as mood disorder or personality disorder. Individuals with schizophrenia spectrum disorders were significantly more likely to

have had an episode of suicidal behaviour requiring emergency care or hospitalization over the last five years.

Service Utilization Characteristics (proximal to death)

Individuals with schizophrenia spectrum disorders were significantly more likely to have mental health system contact in the 30 days before death by suicide than those without. They were more likely to see a primary care provider (PCP) for mental health reasons or a psychiatrist as an outpatient, visit an ED for mental health reasons and to be hospitalized for mental health reasons. A combined variable for outpatient access (PCP or psychiatrist) within the last 30 days prior to death by suicide showed that 45.4% of individuals with schizophrenia spectrum disorders received care, compared with 20.9% of individuals without (Table 2). A combined variable measuring any mental health care (outpatient, ED or hospitalization) raised the percentage of individuals with schizophrenia spectrum disorders who had received care to 53.4% compared with only 25.9% of those without these diagnoses (Table 2).

Comparison with subgroup with history of psychiatric hospitalization

A secondary comparison of suicide victims with a diagnosis of schizophrenia spectrum disorder and suicide victims with a history of psychiatric hospitalization in the five years prior to death (excluding the 30 days before death) was conducted to ensure that the demographic, clinical and proximal service utilization differences seen in the SSD group compared to the control group is specific to SSD rather than severity of mental illness in general.

1,111suicide victims who did not have a diagnosis of SSD, or 19.7% of the total sample, were hospitalized for mental health reasons between 5 years and 30 days before death by suicide (Table 3). 506 participants or 76% of the SSD group were hospitalized for mental health reasons

within the same time period (Table 3). 60.8% of suicide deaths were male, significantly lower than the rate seen in the overall sample (73.7%), but not statistically significant from the SSD group. The SSD group were significantly more likely to be between the ages of 25-34 at time of death) and significantly less likely to be over the age of 65. The SSD group had a significantly higher proportion within the lowest income quintile and were less likely to live in rural areas (Table 3).

With respect to clinical diagnoses, as expected, both the SSD and serious mental illness groups had higher rates of diagnosed alcohol use disorder, drug use disorder, mood disorders and personality disorder than the overall sample (Table 3). However, the serious mental illness group had significantly higher rates of alcohol use disorder and drug use disorder compared with the SSD group. Rates of mood disorder diagnoses were not significantly different (Table 3). Interestingly, higher rates of personality disorder diagnoses were observed in the SSD group than the serious mental illness group, and suicide attempts requiring ED visit or hospitalization in the five years before death were significantly more likely in the SMI group (Table 3).

In the 30 days prior to death, no significant differences between the SSD and SMI groups were found in presence of any visit to primary care provider for mental health reasons, any visit to ED for mental health or mental health hospitalizations. However, suicide victims with SSD were significantly more likely to have seen a psychiatrist within the last 30 days prior to death, and more likely to have had any mental health care (Table 3).

Regression Analysis

A logistic regression analysis was conducted to determine the sociodemographic characteristics, comorbidities, and patterns of service utilization that are independently related to a diagnosis of schizophrenia in those who died by suicide (Table 4).

A schizophrenia diagnosis was significantly more likely in the 24-34 age group compared to the reference range of 45-64 (adjusted odds ratio (AOR) = 1.86, (95% CI 1.44 - 2.42)) (Table 4).

Residing in an area within the top four income quintiles were negatively associated with an SSD diagnosis; for example, the adjusted odds ratio for income quintile 5 (the highest) was 0.50 (95% CI 0.37-0.67) (Table 4). Rural residence was negatively associated with an SSD diagnosis (AOR = 0.68 (95% CI 0.50-0.912 (Table 4).

The pattern of service utilization in the five years before death provided the strongest predictors of an SSD diagnosis in those who die by suicide. Mental health hospitalization within the five years before death strongly predicted an SSD diagnosis (AOR = 7.03 (95% CI 5.59 – 8.84)), as did the presence of any outpatient visit to a family physician or psychiatrist for mental health reasons (AOR = 3.84 (95% CI 2.55 – 5.77) (Table 4). Additional diagnoses of a mood disorder (AOR = 1.25 (95% CI 1.03 – 1.55)) or personality disorder (AOR = 2.12 (95% CI 1.61 – 2.80)) were associated with an SSD diagnosis (Table 4). The presence of suicidal behaviour within 5 years of suicide completion was negatively associated with an SSD diagnosis in our model (AOR = 0.75, (95% CI 0.59-0.96)) (Table 4). Finally, any outpatient mental health care within 30 days of death was independently predictive of an SSD diagnosis (AOR = 1.63, (95% CI 1.34 – 1.98)) (Table 4).

A second regression model was completed to see what factors predict an SSD diagnosis compared to the group of people with a history of psychiatric hospitalization in the absence of a

SSD diagnosis (Table 5). All variables were identical except for hospitalization within the last five years, which was removed from the regression as this was the defining feature of the psychiatric hospitalization group. In this model, the significant predictors of schizophrenia were identical to the model above, with three exceptions: 1)

1) alcohol use disorder was a negative predictor of a SSD diagnosis (AOR = 0.73 (95% CI 0.57 – 0.93)), 2) mood disorder diagnosis within five years of death was not predictive of a SSD diagnosis (AOR = 1.00 (95% CI 0.80 – 1.25), and 3) outpatient mental health care in the five years prior to death was not a significant predicator of an SSD diagnosis (AOR = 1.32 (95% CI 0.81 – 2.14))

Discussion

Over 1 in every 10 suicide deaths in Ontario over a five-year period are associated with a diagnosis of SSD. This estimate is likely the most accurate to date due to the large number of suicides over a large geographic area and duration, as well as the use of a validated algorithm designed to identify cases of SSD diagnosed both in hospital and in the community. SSD diagnoses are strongly overrepresented in those who die by suicide, as the prevalence of schizophrenia spectrum disorder in the general population is less than 1%.(Goldner et al., 2002)

Our study revealed several important demographic differences between suicide victims with and without SSD. Strikingly, almost one out of every four people with SSD who died by suicide was between the ages of 25-34 and over half the individuals with SSD who died by suicide were younger than 45 years of age, unlike the non-SSD population, where almost 60% were over age 45. Many studies have identified young age as a predisposing risk factor for suicide in people with schizophrenia.(Hor and Taylor, 2010) Small studies comparing those with schizophrenia

who die by suicide with other suicide victims have also suggested that this group is significantly younger.(Ishii et al., 2014; Sinyor et al., 2015) Suicide victims with schizophrenia were significantly more likely to live in major urban areas. Rural residence has been associated with higher rates of suicide worldwide.(Hirsch, 2006; Zaheer et al., 2011) Prevalence of schizophrenia and related disorders, however, has been shown to be higher in urban areas.(Krabbendam and van Os, 2005; Lewis et al., 1992)

Our study also highlighted large differences in health service utilization in the 30 days prior to death. Whether prior mental health service utilization differs among those with schizophrenia compared to those without schizophrenia has not been studied previously. In the 30 days before death by suicide, 56% of those with a diagnosis of schizophrenia or related disorders accessed some form of mental health care, compared with 27% of the non-schizophrenia group. Receiving outpatient mental health care was independently predictive of a having a diagnosis of schizophrenia. This rate of mental health services contact is much higher than the 1 in 5 previously cited.(Luoma et al., 2002; Pearson et al., 2009) The frequent access to psychiatric care provides opportunities to screen for suicidal ideation and behaviour, and to implement risk management plans in a group of patients we have identified as high risk.

In order to ensure that the differences we observed were related to diagnosis specific factors rather than simply a function of having a severe mental illness, a secondary comparison and regression analysis was conducted comparing those who die by suicide with SSD and those who die by suicide and have a history of hospitalization within the five years prior to death (excluding the 30 days before death). The predictors of a schizophrenia diagnosis were identical to those comparing the SSD group to the full sample, with only three exceptions – a history of outpatient mental health treatment or diagnosis of a mood disorder within the five years prior to death did

not differentiate the two groups, and, unlike the comparison between SSD suicides and all non-SSD suicides, SSD suicide victims were significantly less likely to have a history of alcohol use disorder compared to suicide victims with severe mental illness.

In general, our findings highlight the importance of a comprehensive suicide risk assessment among individuals with schizophrenia.(Pompili et al., 2016, 2008) This is especially important given the high rate of mental health service use contact in the 30 days prior to suicide.(Giupponi et al., 2014)

Limitations

Our study has several limitations. The gold standard for diagnosis would be a standardized assessment and not a service utilization algorithm; however, we used a validated algorithm to detect cases with psychotic disorder diagnoses that shows high sensitivity and moderate specificity. We are limited to the data available via administrative databases; as such we do not have information on risk factors for suicide including family history, medications prescribed, expressed suicidal ideation or psychosocial stressors. Finally, we can only ascertain suicide when it is coded as such in vital statistics data. It is likely that the number of suicides captured in this study is an underestimate of the true number of suicides, but it is unclear whether individuals with or without schizophrenia spectrum disorder would be more affected by this likely source of missing data.

These limitations are balanced by a large, population-based ascertainment of suicides among which we identified individuals with a diagnosis of schizophrenia or related disorders that were ascertained through both ambulatory and hospitalization settings. Consequently, this is a very

large, representative sample that likely provides, to our knowledge, the most accurate estimates of schizophrenia-specific suicide risk factors.

Conclusions

Our study findings suggest that those with schizophrenia spectrum disorder diagnoses are overrepresented in a sample of those who die by suicide, comprising 11.7% of all suicide deaths, compared to a population prevalence of approximately 1%. SSD suicide victims are younger, more likely to reside in areas in the bottom income quintile and in urban areas, and more likely to seek mental health care in the month prior to death by suicide. The results indicate that clinicians need to be vigilant about suicide risk in young individuals with schizophrenia spectrum disorder, particularly in major urban areas. Our results also suggest that there may be opportunities to intervene because many individuals with schizophrenia spectrum disorders who die by suicide have had contact with the health care system, and most frequently with mental health care providers.

Table 1. Subject Inclusion and Exclusion

Description	Exclusions	Patients
Suicides from Ontario Registered Persons Database (ORPD)		5697
Suicides from other sources		219
Total suicides		5916
Excluded because missing death date	1	5915
Excluded because not Ontario Health Insurance Plan (OHIP) eligible 5 years before suicide	265	5650
Schizophrenia Spectrum Disorders (SSD)		663
Non-SSD		4987

Table 2. Demographic, clinical and service utilization characteristics of 663 with Schizophrenia spectrum disorders (SSD) diagnosis vs. 4987 without SSD diagnosis

Variable	All subjects (n = 5650)	Schizophrenia (n = 663)	No Schizophrenia (n = 4987)	P-Value*
Demographics				
Sex, (n, %)				
M	4163 (73.7%)	429 (64.7%)	3734 (74.9%)	< 0.0001
F	1487 (26.3%)	234 (35.3%)	1253 (25.1%)	
Age (mean, SD)	47.3, SD 17.6	43.7, SD 14.4	47.8, SD 17.9	< 0.0001
Age group (n, %)				
< or = 24	702 (12.4%)	57 (8.6%)	645 (13.0%)	0.0011
25-34	695 (12.3%)	144 (21.7%)	551 (11.1%)	< 0.0001
35-44	1010 (17.9%)	142 (21.4%)	868 (17.5%)	0.011
45-64	2357 (41.7%)	269 (40.6%)	2088 (42.0%)	0.53
65+	886 (15.7%)	51 (7.7%)	835 (16.8%)	< 0.0001
Income Quintile, (n,%)				
1 – low	1424 (25.2%)	250 (37.7%)	1174 (23.5%)	< 0.0001
2 – medium low	1148 (20.3%)	122 (18.4%)	1026 (20.6%)	0.020
3 – medium	1086 (19.2%)	108 (16.3%)	978 (19.6%)	0.041
4 – medium high	991 (17.5%)	87 (13.1%)	904 (18.1%)	0.0013
5 – high	942 (16.7%)	91 (13.7%)	851 (17.1%)	0.031
Missing	59 (1.0%)	<6		
Rural residence				
Yes	940 (16.6%)	62 (9.4%)	878 (17.6%)	< 0.0001
No	4699 (83.2%)	600 (90.5%)	4099 (82.2%)	
Missing	11 (0.2%)		<6	
Clinical Characteristics (excluding 30 days before death)				
Aggregated Diagnosis Group (ADG) score over last five years (mean, SD)	8.1 SD 4.3	9.0 SD 4.3	8.0 SD 4.3	< 0.0001
Alcohol use disorder diagnosis within the last five years (n, %)	1032 (18.3%)	188 (28.4%)	844 (16.9%)	< 0.0001
Drug use disorder diagnosis within the last five years (n, %)	1235 (21.9%)	276 (41.6%)	959 (19.2%)	< 0.0001
Mood disorder diagnosis within the last five years (n, %)	1804 (31.9%)	411 (62.0%)	1393 (27.9%)	< 0.0001
Personality disorder diagnosis within the last five years (n, %)	331 (5.9%)	124 (18.7%)	207 (4.2%)	< 0.0001
Any visit to primary care provider (PCP) for mental health reasons within the last five years (n, %)	3507 (62.1%)	572 (86.3%)	2935 (58.9%)	< 0.0001

Any visit to an outpatient psychiatrist within the last five years (n, %)	2092 (37.0%)	568 (85.7%)	1524 (30.6%)	< 0.0001
Any visit to emergency department (ED) for mental health reasons within the last five years (n, %)	1704 (30.2%)	506 (76.3%)	1198 (24.0%)	< 0.0001
Any mental health hospitalization within the last five years (n, %)	1615 (28.6%)	504 (76.0%)	1111 (22.3%)	< 0.0001
Any suicidal behaviour requiring emergency department (ED) care within the last five years (n, %)	784 (13.9%)	187 (28.2%)	597 (12.0%)	< 0.0001
Proximal mental health service utilization				
Any visit to primary care provider (PCP) for mental health reasons within the last one month (n, %)	829 (14.7%)	132 (19.9%)	697 (14.0%)	0.004
Any visit to psychiatrist within the last one month (n, %)	663 (11.7%)	210 (31.7%)	453 (9.1%)	< 0.0001
Any visit to emergency department (ED) for mental health reasons within the last one month (n, %)	394 (7.0%)	82 (12.4%)	312 (6.3%)	< 0.0001
Any mental health hospitalization within the last one month (n, %)	424 (7.5%)	87 (13.1%)	312 (6.3%)	< 0.0001
Combined outpatient access (PCP or Psychiatrist) within last one month (n, %)	1342 (23.8%)	301 (45.4%)	1041 (20.9%)	< 0.0001
Any mental health care (Outpatient, ED or hospitalization) within the last one month (n, %)	1649 (29.2%)	355 (53.5%)	1294 (25.9%)	<0.0001
Any suicidal behaviour requiring emergency department (ED) care within the last one month (n, %)	419 (7.4%)	47 (7.1%)	372 (7.5%)	0.73

***P Value – reflects comparison of Schizophrenia vs. No Schizophrenia sample.**

Table 3. Demographic, clinical and service utilization characteristics of 663 with Schizophrenia spectrum disorders (SSD) diagnosis vs. 1111 with serious mental illness*

Variable	Schizophrenia Spectrum Disorders (n = 663)	Non-Schizophrenia Mental Illness* (n = 1111)	P-Value
Demographics			
Sex, (n, %)			
M	429 (64.7%)	676 (60.8%)	0.11
F	234 (35.3%)	435 (39.2%)	
Age (mean, SD)	43.7 SD 14.4	47.5, SD 16.7	< 0.001
Age group (n, %)			
< or = 24	57 (8.6%)	118 (10.6%)	0.17
25-34	144 (21.7%)	133 (12.0%)	< 0.001
35-44	142 (21.4%)	218 (19.6%)	0.36
45-64	269 (40.6%)	482 (43.4%)	0.25
65+	51 (7.7%)	160 (14.4%)	< 0.001
Income Quintile, (n,%)			
1 – low	250 (37.7%)	261 (23.5%)	< 0.001
2 – medium low	122 (18.4%)	271 (24.4%)	0.003
3 – medium	108 (16.3%)	208 (18.7%)	0.20
4 – medium high	87 (13.1%)	175 (15.8%)	0.13
5 – high	91 (13.7%)	189 (17.0%)	0.066
Missing	<6		
Rural residence			
Yes	62 (9.4%)	155 (14.0%)	0.016
No	600 (90.5%)	954 (85.9%)	
Missing		<6	
Clinical Characteristics (excluding 30 days before death)			
Aggregated Diagnosis Group (ADG) score over last five years (mean, SD)	9.0 SD 4.3	10.0 SD 4.0	< 0.001
Alcohol use disorder diagnosis within the last five years (n, %)	188 (28.4%)	408 (36.7%)	< 0.001
Drug use disorder diagnosis within the last five years (n, %)	276 (41.6%)	517 (46.5%)	0.044
Mood disorder diagnosis within the last five years (n, %)	411 (62.0%)	667 (60.0%)	0.42

Personality disorder diagnosis within the last five years (n, %)	124 (18.7%)	115 (10.4%)	< 0.001
Any visit to primary care provider (PCP) for mental health reasons within the last five years (n, %)	572 (86.3%)	969 (87.2%)	0.57
Any visit to an outpatient psychiatrist within the last five years (n, %)	568 (85.7%)	796 (71.6%)	< 0.001
Any visit to emergency department (ED) for mental health reasons within the last five years (n, %)	506 (76.3%)	741 (66.7%)	< 0.001
Any mental health hospitalization within the last five years (n, %)	504 (76.0%)	1111 (100.0%)	< 0.001
Any suicidal behaviour requiring emergency department (ED) care within the last five years (n, %)	287 (28.7%)	453 (40.8%)	< 0.001
Proximal mental health service utilization			
Any visit to primary care provider (PCP) for mental health reasons within the last one month (n, %)	132 (19.9%)	213 (19.2%)	0.70
Any visit to psychiatrist within the last one month (n, %)	210 (31.7%)	234 (21.1%)	< 0.001
Any visit to emergency department (ED) for mental health reasons within the last one month (n, %)	82 (12.4%)	115 (10.4%)	0.55
Any mental health hospitalization within the last one month (n, %)	87 (13.1%)	147 (13.2%)	0.95
Combined outpatient access (PCP or Psychiatrist) within last one month (n, %)	301 (45.4%)	393 (35.4%)	< 0.001
Any mental health care (Outpatient, ED or hospitalization) within the last one month (n, %)	355 (53.5%)	485 (43.7%)	<0.001

Any suicidal behaviour requiring emergency department (ED) care within the last one month (n, %)	47 (7.1%)	111 (10.0%)	< 0.001

*Non-Schizophrenia Mental Illness includes individuals who had a psychiatric hospitalization in the 5 years prior to suicide.

Table 4: Logistic regression results associated with schizophrenia among the total suicide sample.

Factor	Odds Ratio	95% Confidence Limits	p-value
Demographics			
sex M vs F	1.04	0.85 – 1.28	0.71
Age, <24 vs 45-64	0.84	0.60 - 1.18	0.31
Age, 25-34 vs 45-64	1.86	1.44 – 2.42	< 0.0001
Age, 35-44 vs 45-64	1.21	0.95 - 1.55	0.12
Age, >=65 vs 45-64	0.74	0.53 – 1.05	0.09
Income quintile, 2nd vs 1st (lowest)	0.52	0.40 - 0.68	< 0.0001
Income quintile, 3rd vs 1st	0.53	0.40 - 0.69	< 0.0001
Income quintile, 4th vs 1st	0.47	0.35 – 0.63	< 0.0001
Income quintile, 5th vs 1st	0.50	0.37 - 0.67	< 0.0001
Rural vs. urban	0.68	0.50 – 0.92	0.012
Clinical Characteristics			
Aggregated Diagnosis Group (ADG) score, within five years of death	0.96	0.94 – 0.99	0.003
Alcohol use disorder diagnosis, within five years of death	0.83	0.66 – 1.05	0.12
Drug use disorder diagnosis, within five years of death	1.10	0.88 – 1.38	0.41
Mood disorder diagnosis, within five years of death	1.26	1.03 – 1.55	0.028
Personality disorder diagnosis, within five years of death	2.12	1.61 – 2.80	< 0.0001
Any outpatient mental health visit, within five years of death (family physician or psychiatrist)	3.84	2.55 – 5.77	< 0.0001

Any mental health hospitalization, within five years of death	7.03	5.59 – 8.84	< 0.0001
Any suicidal behaviour requiring emergency department or hospital care, within five years of death	0.75	0.59 – 0.96	0.021
Proximal Mental Health Service Utilization			
Any outpatient mental health visit, within one month of death (family physician or psychiatrist)	1.63	1.34 – 1.98	< 0.0001
Any mental health hospitalization, within one month of death	1.20	0.88 – 1.64	0.25
Any suicidal behaviour requiring emergency department or hospital care, within one month of death	0.73	0.50 – 1.07	0.11

Table 5: Logistic regression results associated with schizophrenia among individuals with schizophrenia or non-schizophrenia mental illness*.

Factor	Odds Ratio	95% Confidence Limits	p-value
Demographics			
sex M vs F	1.06	0.85 – 1.32	0.63
Age, <24 vs 45-64	0.87	0.60 – 1.27	0.48
Age, 25-34 vs 45-64	1.86	1.38 – 2.50	< 0.0001
Age, 35-44 vs 45-64	1.17	0.89 - 1.53	0.28
Age, >=65 vs 45-64	0.71	0.49 – 1.03	0.067
Income quintile, 2nd vs 1st (lowest)	0.47	0.35 - 0.63	< 0.0001
Income quintile, 3rd vs 1st	0.54	0.40 - 0.73	< 0.0001
Income quintile, 4th vs 1st	0.49	0.36 – 0.68	< 0.0001
Income quintile, 5th vs 1st	0.48	0.35 - 0.66	< 0.0001
Rural vs. urban	0.66	0.47 – 0.92	0.014
Clinical Characteristics			
Aggregated Diagnosis Group (ADG) score, within five years of death	0.95	0.93 – 0.98	0.0005
Alcohol use disorder diagnosis, within five years of death	0.73	0.57 – 0.92	0.0085
Drug use disorder diagnosis, within five years of death	0.99	0.78 – 1.26	0.94
Mood disorder diagnosis, within five years of death	1.00	0.80 – 1.25	0.99
Personality disorder diagnosis, within five years of death	1.92	1.42 – 2.59	< 0.0001
Any outpatient mental health visit, within five years of death (family physician or psychiatrist)	1.32	0.81 - 2.14	0.27
Any suicidal behaviour requiring emergency department or hospital care, within five years of death	0.59	0.46 – 0.75	< 0.0001
Proximal Mental Health Service Utilization			
Any outpatient mental health visit, within one month of death (family physician or psychiatrist)	1.47	1.18– 1.83	0.0005
Any mental health hospitalization, within one month of death	1.08	0.77 – 1.50	0.66

Any suicidal behaviour requiring emergency department or hospital care, within one month of death	0.77	0.51 – 1.15	0.20

*Non-Schizophrenia Mental Illness includes individuals who had a psychiatric hospitalization in the 5 years prior to suicide.

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